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Assessment of Physico-Chemical Characteristics of Groundwater Quality of Ajmer City in Rajasthan

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ABSTRACT

Studies of Physico-chemical parameters of groundwater quality based on Physico-chemical parameters of Ajmer city in Rajasthan have been taken up to evaluate its suitability for domestics purpose. 21 ground water samples were collected from different places of Ajmer city in Rajasthan. The quality analysis has been made through the pH, EC, TDS, Dissolved Oxygen, BOD, COD, Total Hardness, Sodium, Potassium, Calcium, Magnesium, Chloride, Sulphate, Nitrate, Fluoride and Alkalinity. A systematic calculation of the correlation coffecient has also been carried out between different analysed parameters. Comparative studies of samples in different seasons were conducted and it was found that Electrical Conductivity and Total Dissoved Solids (TDS) were decreased. Alkalinity and Total Hardness were increased after the rainfall. Ajmer is one of the major and oldest cities in the Indian state of Rajasthan and the centre of the eponymous Ajmer District. It is located at the centre of Rajasthan, and is home to the Ajmer Sharif shrine. The city was established as "Ajayameru" (translated as "Invincible Hills") by a Chahamana ruler, either Ajayaraja I or Ajayaraja II, and served as their capital until the 12th century CE. Ajmer is in the northwest of India and is surrounded by the Aravali Mountains. It is situated on the lower slopes of the Taragarh Hill of that range. To the northwest is the Nagapathar Range of the Aravali Mountain Ranges which protects it from desertification from the Thar Desert.

KEYWORDS: *pH, EC, TDS, Dissolved Oxygen, BOD, COD, Total Hardness, Sodium, Potassium, Calcium, Magnesium*

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INTRODUCTION

Groundwater is the water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.

Groundwater is recharged from the surface; it may discharge from the surface naturally at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal, and industrial use by constructing and operating extraction wells. The study of the distribution and movement of groundwater is hydrogeology, also called groundwater hydrology. Typically, groundwater is thought of as water flowing through shallow aquifers, but, in the technical sense, it can also contain soil moisture, permafrost (frozen soil), immobile water in very low permeability bedrock, and deep geothermal or oil formation water. Groundwater is hypothesized to provide lubrication that can possibly influence the movement of faults. It is likely that much of Earth's subsurface contains some water, which may be mixed with other fluids in some instances.

Groundwater is often cheaper, more convenient and less vulnerable to pollution than surface water. Therefore, it is commonly used for public water supplies. For example, groundwater provides the largest source of usable water storage [1]

Use of groundwater has related environmental issues. For example, polluted groundwater is less visible and more difficult to clean up than pollution in rivers and lakes. Groundwater pollution most often results from improper disposal of wastes on land. Major sources include industrial and household chemicals and garbage landfills, excessive fertilizers and pesticides used in agriculture, industrial waste lagoons, tailings and process wastewater from mines, industrial fracking, oil field brine pits, leaking underground oil storage tanks and pipelines, sewage sludge and septic systems.

Groundwater forms a major source of drinking water. The modern civilization, industrialisation, urbanisation and increase in population have lead to fast degradation of our ground water quality. As the water is the most important component of eco-system, any imbalance created either in term of amount, which is presence of imputities added to it can hard the whole eco-system. Excess of fluoride causes dental, skeletal and non skeletal fluorosis through continued use of fluoride contaminated water, air and agriculture produce. Studies in the areas of Ajmer city in Rajasthan were done and analysed the water from the wells. It was found that fluoride contents from the wells from different sites to vary from 0.87 to 1.01ppm. Groundwater contains various types of pollutants and several other substances are dissolved in it. Concentration of which is useful for human body but in a specific limit. The study was conducted to know the physico chemical properties of ground water and in different seasons and its impact on human life.

MATERIALS AND METHODS

Water Samples were collected in Polythene bottles of 2.5 litres and 2.0 litres. The samples were collected from

borewells as well as from deep handpumps at different seasons. It was ensured that the concentrations of various water quality parameters do not changes in time that elapses between drawing of samples and the analysis in the laboratory. For DO, BOD and COD separate 2 litres polythene bottles were used. The bottles were thoroughly cleaned with Hydrochloric acid and then washed with tap water rendered free of acid and then washed with distilled water twice and again rinsed with the water sample to be collected and then filled up the bottle with the sample leaving only a small air gap at the top, stoppered and sealed the bottle with parrafin wax. Some samples which were turbid or containing suspended matter were filtered at the time of collection. All the galssware, casserole and other pipettes were first cleaned with tap water thoroughly and finally with deionised distilled water. The pipettes and burette were rinsed with solution before final use. The the chemicals and reagent were used for analysis were of analar grade. The pH meter, conductivity meter, spectrophotometer, flame photometer instruments were used to analyze these parametres. The procedure for calculating the different parameters were conducted in the laboratory. The samples collected different areas of Ajmer city in Rajasthan were analyzed and results presented further.[2,3]

RESULTS AND DISCUSSION

Ajmer has a hot, semi-arid climate with over 55 centimetres (22 inches) of rain every year, but most of the rain occurs in the monsoon months, between June and September. Temperatures remain relatively high throughout the year, with the summer months of April to early July having an average daily temperature of about 30 °C (86 °F). During the monsoon there is frequent heavy rain and thunderstorms, but flooding is not a common occurrence. The winter months of November to February are mild and temperate with average temperatures ranging from 15–18 °C (59–64 °F) with little or no humidity. There are, however, occasional cold weather fronts that cause temperatures to fall to near freezing levels.[4]

The value of pH was within maximum permissible limit in all the 21 samples. The Electrical conductivity was ranging from 564 to 5870 µm/cm and in 61.9% samples the E.C. was out of maximum permissible limit. The Total Hardness (TH) of samples was ranging from 80 to 1850. 28.6% samples were out of maximum permissible limit. Total Dissolved Solids (T.D.S.) value were ranging from 301 to 3572 and 381.1 % of the samples were out of maximum permissible limit. Calcium values were ranging from 12 to 88 and Sulphate values were ranging from 5 to 900. In calcium all the samples were within maximum permissible limit and sulphate content was more in 4.8% samples. Value of Potassium were ranging from 24 to 736 and 57.1% samples were out of maximum permissible limit. Fluoride contents were ranging from 0.50 to 11 and in 33.3 % samples it was more than maximum permissible limit. Nitrate value was ranging from 10 to 159 and 38.1% samples were having value more than maximum permissible limit. Alkalinity was ranging from 100 to 952 and in 4.8% samples it was more than maximum permissible limit. Chlorine content was ranging from 35 to 1320 and in 9.5% samples it was more than maximum permissible limit. Magnesium was more than 100 in 4(19%) samples. Biochemical Oxygen Demand (BOD) were ranging between 6 to 20, it was within the maximum permissible limit in 33.33% samples. Chemical Oxygen Demand (COD) were ranging from 28-178. In all samples COD was more than maximum permissible limit. Dissolved Oxygen (DO) were ranging 2.8 to 12.5 on samples were measured. Only in 20% of the samples, it was within the permissible limit. Pre-monsoon and post monsoon samples were collected from different locations. It was found that there are no major changes in chemical properties of the samples. It was due to the fact that the rainfall in the state was less by 33.6% in 2000. Ground water recharge was very less. Although in summer seasonal concentration of solids were higher than rainy season and at the same time Alkanity of the samples shown down trend from summer season to rainy season.[5]

Almost entire city of Ajmer is facing problem of ground water scarcity, though water supply from Bisalpur dam solved drinking water problem to certain extent in urban areas. Over the greater part of the district occupied by hard formation the well yields are very poor. As such the depth of weathered zone is generally restricted up to 50m, which control the occurrence and movement of groundwater. Deep-seated fractures below 100m are very rare. This causes reduction in the well yield drastically during the summers creating acute water shortage of domestic water supply. However, in selective areas located on structural weak planes connected to some recharge source wells continue to yield moderate quantity of water. Deeper levels are either devoid of water or of poor quality of ground water (brackish to saline). Alluvium occurs at limited places along the major drainage/ valley fill and has shallow thickness. The well yield varies considerably year to year in different parts of the district and over the season. Thus the availability of surface as well as ground water is very scarce in low rainfall years & especially in summer months.[6]

A Mass Awareness Programme on "Ground Water Management in Pushkar Valley" was organized at Pushkar, Ajmer district on 14th February 2002. Dr D K Chaddha, Chairman, Central Ground Water Authority, New Delhi presided over the function. Shri Ramzan Khan, MLA, Pisangan (Ajmer district) & Shri Hira Singh, MLA, Raipur, (Pali district) were special guests on the occasion. Shri S S Chauhan, Member (ED & MM), Central Ground Water Board, Faridabad also graced the occasion as special guest. Shri Ram Singh Vishnoi, Minister for Public Health & Engineering Department also graced the occasion. During the programme, all the members and local people presented their views to check declining ground water levels in Pushkar Valley.

A one day Training Programme on "Rainwater Harvesting for Artificial Recharge to Ground water" was organized at Ajmer on 13th December 2005. Prof M L Chhipa, Vice Chancellor, Maharshi Dayanand Saraswati University (MDSU), Ajmer was the Chief Guest during inaugural function. The function was presided over by Shri Mahaveer Singh, Collector, Ajmer. Prof A K Sinha, Department of Geology, University of Rajasthan and Prof K C Sharma, Head of Department, Environment Studies, MDSU, Ajmer were Special Guests. Shri A D Joseph, Regional Director, Central Ground Water Board, Western Region, Jaipur & other officers from CGWB imparted training. Lectures were also delivered by Prof A K Sinha and officers from various State Government Agencies including Ground Water Department, Irrigation Department and Public Health & Engineering Department, etc. Representative of non-government organization participated in the training. An exhibition was also organized during the training programme.[7]

CONCLUSION

The study carried out in Ajmer city in Rajasthan on ground water samples conform that the pH level of ground water was within limit. In 13 samples were having Electrical Conductivity more than Maximum Permissible Limit. It is said that these water cannot be used for drinking purpose. The value of T.D.S. were more than maximum permissible limit in 8 samples, these sample water are not suitable for drinking but samples which are having TDS more that 3000 water cannot be used even for irrigation purposes, only 1 samples were found which are having TDS more than 3000. Excess fluoride may lead to tooth decay and kidney disease. In 7 samples the fluoride was found more than maximum permissible limit and it is very high. The need for new institutional economics approach to deal with current and emerging problems has become very crucial. In most of the states, the problem of ground water depletion and quality deterioration has appeared in last few years.

Ground water draft is very. Stage of ground water development in the district has reached 122% due to indiscriminate use. It has to be controlled by preventing further development. Revival of traditional ground water storage system i.e. Baori, open wells, Tanka etc for rainwater conservation for use in day to day life will reduce ground water draft. Awareness programmes and training on rainwater harvesting will be beneficial to check the decline in water level and justified use. Taking advantage of uneven topography of the area, small check dams or earthen dams, upstream of irrigation commands, at suitable sites, may be constructed to store rainwater. This will increase recharge to ground water which ultimately result in increase of yield of wells. An area of 547.37 sq km is occupied by forest. To protect the area from environmental degradation, extensive programme of a forestation and soil conservation measures may be taken up. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. Maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective cropping pattern can achieve this. Alluvial tracts along river channels of Banas, Kothari, Khari, Manusi and Chandrabhaga are most feasible locations where shallow wells can be constructed to harness the shallow water table aquifers being potentially recharged by the flash flood and surface runoff. These wells can be used for water supply, wherever feasible. Surface runoff can be harnessed by constructing tanks at feasible sites in the area occupied by the hard rock terrain for supplementing irrigation potential to increase the agricultural production. High water requirement crops be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.

FUTURE SCOPE

Due to over development, further exploitation of precious resource must be checked. For sustainable development of ground water, artificial recharge measures to be employed to augment ground water and surface water resources. Exploratory drilling results show potential zone having inferior quality water, which can be blended with fresh water for irrigation use. Since the stage of ground water development has already crossed 100%, artificial recharge is the only solution to augment ground water through construction of bunds, anicuts, and rooftop harvesting structures. The area has undergone polyphase deformation in geological past, which has resulted in a complex structure (folded, faulted and jointed) that may not be conducive for such structures. Therefore, site of these structures should be selected carefully. Impact assessment of check dams revealed that increase in water level, cropping area, cropping intensity, crop production and labor employment observed in the project area. Erosion from nalah bank minimizes. Cropping pattern and cropping intensity changed. Harvested water provides supplementary irrigation during long dry spell. In view of the above, such artificial recharge programmes may be taken up in the district for further development of surface water and ground water resources to enhance agricultural production

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